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Let $n=1$. The numbers are 21, 12.
Let $n=2$. The numbers are 31, 13.
Let $n=1.11$, $y=0$. The numbers are 10, .01.
Let $n=2.22$, $y=0$. The numbers are 20, .02.
Let $n=3.33$, $y=0$. The numbers are 30, .03.

Also solved by *J. H. DRUMMOND* and *J. K. ELLWOOD*.

154. Proposed by J. SCHEFFER, A. M., Hagerstown. Md.

Suppose there is a meadow of 8 acres in which the grass grows uniformly, and that 21 oxen could eat up the whole pasture in 6 weeks, or 18 oxen in 9 weeks; what number of oxen diminished by the removal of 9, at the end of 14 weeks, could eat it up in 18 weeks?

I. Solution by G. B. M. ZERR. A. M., Ph.D., Professor of Chemistry and Physics, The Temple College, Philadelphia, Pa.

In the first case, in one week one ox will eat ($\frac{1}{6}$ of $\frac{8}{21}$ of original grass$+\frac{8}{21}$ of what grows) on one acre$=\frac{4}{63}$ of original grass on one acre$+\frac{8}{21}$ of what grows on one acre.

In the second case, in one week one ox will eat ($\frac{1}{9}$ of $\frac{8}{18}$ of original grass $+\frac{8}{18}$ of what grows) on one acre$=\frac{4}{81}$ of original grass on one acre$+\frac{4}{9}$ of what grows on one acre.

In each case one ox eats the same quantity in one week.

$\therefore\ \frac{4}{9}-\frac{8}{21}=\frac{4}{63}$ of the growth of one acre in one week is $=\frac{4}{63}-\frac{4}{81}=\frac{8}{576}$ of an acre. $\frac{8}{576}\div\frac{4}{63}=\frac{2}{9}$ of an acre, what grows on an acre in one week. $\frac{4}{63}+\frac{8}{21}$ of $\frac{2}{9}=\frac{4}{27}$, the part of the original quantity which one ox eats in one week.

$8\div(6\times\frac{4}{27})=9$ oxen to eat original grass. $21-9=12$ oxen necessary to eat growing grass.

Now change "at the end of 14 weeks" to "at the end of 4 weeks." Otherwise we will have same hungry oxen. 8 acres$=\frac{2}{9}\times18\times8=40$ acres of original grass$=$amount on 8 acres$+$what grows on 8 acres in 18 weeks.

Then $4\times\frac{4}{27}$ oxen$+14\times\frac{4}{27}$ (oxen-9)$=40$.

$\therefore$ 72 oxen$=1080+504=1584$. $\therefore$ oxen$=22$, the number required.

Also solved by *J. R. HITT*.

II. Solution by the PROPOSER.

Let a be the number of pounds of grass on 1 acre, and an that which grows on 1 acre in 1 week. Then 21 oxen eat $(8a+8an\times6)$ pounds in 6 weeks, and 18 oxen eat $(8a+8an\times9)$ pounds in 9 weeks.

$\therefore$ From the first statement, 1 ox eats $\dfrac{4(1+6an)}{63}$ pounds in 1 week.

From the second statement, 1 ox eats $\dfrac{4(1+9an)}{81}$ pounds.

$$\therefore\ \frac{4(a+9an)}{81}=\frac{4(a+6an)}{63},\ \text{whence } n=\tfrac{2}{9}.$$

Let x=the required number of oxen. Then x oxen will eat $\dfrac{56ax}{27}$ pounds in 14 weeks, and $(x-9)$ oxen will eat $\frac{16}{27}a(x-9)$ pounds in 4 weeks.

$$\therefore \frac{56ax}{27}+\frac{16a}{27}(x-9)=8(a+18an)=40a, \text{ whence } x=22, \text{ number required.}$$

Also solved by *J. R. HITT.*

Solutions of problem 152 were received from *J. K. ELLWOOD* and *J. R. HITT.*

ALGEBRA.

NOTE ON SOLUTION I. OF PROBLEM 131.

In connection with this solution it is well to note that Dr. Zerr's results hold only for the case where a, b, c, and d are all positive, and a^2d+b^2c-cd is positive, restrictions which he neglects to mention. For instance, the equation $2x-1+\sqrt{(5x^2+1)}=0$ possesses two roots, 0 and -4, yet $c>a^2$ or $5>2^2$.

The criteria of the second solution cover all real values of a, b, c, and d, positive or negative, and a^2d+b^2c-cd positive.

H. S. VANDIVER, Bala, Pa.

133. Proposed by **HARRY S. VANDIVER, Bala, Pa.**

A theory of Fermat. The sum of two integral fourth powers cannot be an integral square. [Cf. *Chrystal's Algebra*, Vol. II, page 535.]

I. Solution by **L. C. WALKER, A. M., Professor of Mathematics, Petaluma High School, Petaluma Cal., and CHAS. C. CROSS, Whaleyville, Va.**

Assume m and n to be the numbers, then by the condition of the problem, we have

$$(m^2)^2+(n^2)^2=c^2, \text{ suppose......(1).}$$

In (1) either m^2 or n^2 must be even, and the other odd, because the sum of two odd squares can not be a square.

Assume m^2 even and n^2 odd.

Let $m^2=2pq$ and $n^2=p^2-q^2$; or $n^2+q^2=p^2$......(2).

In (2) n and p are odd and q even. Now let $q=2\alpha\beta$ and $p=\alpha^2+\beta^2$. Then we find $m^2=4\alpha\beta(\alpha^2+\beta^2)$......(3).

Since α and β are prime to each other, in order that $\alpha\beta$ may be a square, each must be a square.

Let $\alpha=m_1^2$ and $\beta=n_1^2$. Substituting in (3), we get

$$m^2=4m_1^2n_1^2(m_1^4+n_1^4)\text{......(4).}$$

In order that the right member of (4) may be a square, we must have $m_1^4+n_1^4=c_1^2$, say; which is of the same form as (1). But c_1^2 is less than c^2.

Proceeding in exactly the same way, we can reduce c^2 indefinitely by some integer. By our hypothesis c^2 can not be zero, nor less.

Hence, results *Fermat's Theorem.*

Also solved by *G. B. M. ZERR.*